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ANTIOXIDANT ROLE OF EXTRACT FROM CHILLIS (*CAPSICUM ANNUM* L.) ON ZINC INDUCED ALTERATIONS IN THE OXYGEN CONSUMPTION OF FRESHWATER MUSSELS, *LAMELLIDENS CONSOBRINUS*

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ABSTRACT

The present study describes antioxidant role of green chillis(*Capsicum annum* L.)extract against zinc sulphate induced toxicity in an experimental model, the fresh water mussels, *Lamellidens consobrinus*. The effect of mussel was studied under five groups. Group A was maintained as control, Group B mussels were exposed to chronic LC_{50/10} doses of zinc sulphate (0.21 ppm) for 21 days, while group C mussels were exposed to respective chronic concentrations of heavy metals with 5 ml/lit of extract from *Capsicum annum* L. Rates of O₂ consumption from all groups were estimated after 7, 14 and 21 days. Mussels from B groups were divided into two groups after 21 days exposure to heavy metals into D & E groups. Mussels of D group were allowed to cure naturally while those of E were exposed to extract from *Capsicum annum* L. (5 ml/lit) and their rates of O₂ consumption were studied after 7, 14 and 21 days. Remarkable decrease in rate of O₂ consumption was observed in zinc exposed mussels. The groups exposed to heavy metals along with extract from *Capsicum annum* L. showed more rates of oxygen consumption than those exposed to heavy metals. Pre-exposed mussels to heavy metals showed fast recovery and higher rate of oxygen consumption than those which were allowed to cure naturally. The probable antioxidant role of extract from *Capsicum annum* L. is discussed in the paper.

Keywords: Zinc, *Capsicum Annum* L, Antioxidant Activity and Oxygen Consumption

INTRODUCTION

Aquatic pollution is of great concern because every organism depends upon water. Zinc which has been recognized as a toxic metal, has become common aquatic pollution in recent year due to it wild spread use in industrial like zinc smelters, electroplating, alloy and pigment factories. Zinc has become hazardous causing metabolic, physiological, structural and functioning disorders of aquatic animals (Kraak and Scholen, 1991). Heavy metals reach the aquatic bodies deteriorate the quality the quality of life sustaining water and cause damage to both flora and fauna (Zyadah and Abdeb, 2000; Georgudaki, 1991; Verma *et al.*, 2005; Sharma and Agrawal, 2005). The problem of heavy metal accumulation increases due to their non biodegradable property, bioaccumulation and biomagnifications (Burman and Lal, 1994; Sandres, 1977; Pitter 1999; Lodhi *et al.*, 2006) zinc is used in preparation of alloys, galvanizing iron, electroplating, metal, spraying, electrical phases batteries and cabal wrappings (Merk, 1998). The toxicity of heavy metal zinc cf and hg on *Lamellidens consobrinus* shows the rate of mortality for any fix time increase with increase in concentration with increase in exposure time. The toxicity of heavy metal zinc affect the respiratory and nervous system of animal (Bhamre *et al.*, 2010). Our body is exposed to large no. of foreign chemicals everyday (Santhakumari *et al.*, 2003) free radicles are also generated, during normal metabolism of aerobic cells. (Carmen and Florin, 2009; Ghasem *et al.*, 2009; Hunag *et al.*, 2005; Odukoya *et al.*, 2007) . An earlier study reported that the green chilli has strong antioxidant activity (Turkmen *et al.*, 2005). Banerjee *et al.*, (2005) reported that the phenolics of green peeper has high DPPH radical scavenging capacity. High activity of enzymes associated with antioxidative system (Superoxide Dismutase, catalase, xanthine oxidase). The fresh water bivalves (*Lamellidens consobrinus*) was selected

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for experimentation the present investigation were subjected to effect of heavy metal zinc on oxygen consumption of fresh water bivalve *Lamellidens consobrinus*. The effect of antioxidant extracts on the oxygen consumption. The antioxidants reduces the respiratory stress in the bivalve.

Capsicum is the genus of plants from the solanaceae family the common pepper name is chilli or peeper. This contains wide phytochemicals such as acidic phenolic compounds which are important nutritional antioxidants that may reduce the risk of degenerative, chronic and mutagenic diseases (Lee *et al.*, 1995; Howard *et al.*, 2000; Yahya, 2000). Carotenoids, which are fat soluble antioxidants found in peppers, have antioxidant properties (Rao and Rao, 2007). Several studies have demonstrated the antimicrobial activity of peppers (Cichewicz and Therpe, 1996; Wahba *et al.*, 2010). Now a day's chilli is an important vegetables crops and used world-widely as for flavour, aroma and add colour to foods (Zhuang *et al.*, 2012). In peppers, there are phytochemical property that have many biochemical and pharmacological properties which includes antioxidants, anti-inflammatory, antiallergenic and anti- carcinogenic activities (Lee *et al.*, 2005). It also has been proven that, ripe red peppers can reduce the risk of cancer (Nishino *et al.*, 2009). This study was carried out to investigate the probable antioxidant role of extract from *Capsicum annum* L (chillies) extracts on physiology of oxygen consumption of zinc sulphate intoxicated in an experimental model, the fresh water mussels, *Lamellidens consobrinus*.

MATERIALS AND METHODS

Preparation of Aqueous Extract of *Capsicum Annum*

The plant *Capsicum annum* Linn (1 kg) was collected from a local market in Bhusawal (M.S.), India. The dried green chillies were ground to a fine powder and were extracted with boiling water (5 L) for 30 min by Soxhlet technique. The filtrate was evaporated at $< 70^{\circ}\text{C}$ in a vacuum dryer to give a final yield of 128.69 g. was stored at 4°C . It was dissolved in distilled water whenever needed for experiments.

Treatment of Heavy Metal Salt

Healthy active animals of approximately same size and weight were chosen. The acclimatized active mussels were divided into three groups, such as group A, B, and C. The group A of acclimatized mussels as kept as control set. The group B of acclimatized mussels was exposed to chronic concentrations (LC_{50} value of 96 hr/10) of heavy metal salt ZnSO_4 (0.21 ppm) as chronic doses up to 21 days, while group 'C' of acclimatized bivalve was exposed to chronic concentration (LC_{50} value of 96 hr /10) with 5 ml/lit extract from *Capsicum annum* up to 21 days.

After exposure to heavy metal for mussels from group 'B' were divided into two subgroups, such as D & E groups. The mussels of group 'D' were allowed to self cure naturally in normal water and the mussels of group 'E' were exposed to 5 ml/lit extract from *Capsicum annum* up to 21 days. During experimentation mussels were fed on fresh water algae. O_2 consumption by mussels from all groups was determined by Wrinkler's method after every 7 days.

RESULTS AND DISCUSSION

Observations and Results

Lamellidens consobrinus. after exposure to concentration of zinc sulphate (0.21 ppm) along with extract from *Capsicum annum* and during recovery have been summarised in table.

It was observed that after chronic treatment of zinc sulphate upto 21 days to, *Lamellidens consobrinus*. The rate of oxygen consumption decreased significantly. In the mussels, the rate of oxygen consumption was measured after 7, 14 and 21 days exposure to ppm zinc sulphate as chronic treatment. It was observed that after chronic exposure there was a significant decrease in the rate of oxygen consumption, as compared to that of control bivalves summarized in table.

Oxygen consumption data from table indicates that, the rate of oxygen consumption in presence of ZnSO_4 (0.21 ppm) decreased with the increase in exposure period. The rate of O_2 consumption was more in ZnSO_4 and extract from *Capsicum annum* exposed mussels as compare to those exposed to only ZnSO_4 in respective period of exposure. The mussels, pre-exposed to ZnSO_4 showed fast recovery of rate of O_2 consumption in presence of extract from *Capsicum annum* than those allowed to cure naturally.

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Table 1: (A) The rate of oxygen consumption of *Lamellidens consobrinus* after chronic exposure to heavy metal salt, ZnSO₄ and ZnSO₄ with 5ml/lit. extract of *Capsicum annum*

Treatment	Average O ₂ consumed ml/gm/hr/lit. \pm S.D.		
	7 Days	14 Days	21 Days
(A) Control	0.0891 \pm 0.0224	0.0887 \pm 0.0361	0.0884 \pm 0.0374
(B) 0.21 ppm ZnSO ₄	0.0795 \pm 0.0436 (-10.77 %)	0.0784 \pm 0.0332 11.61 %	0.0771 \pm 0.0819 12.78 %
(C) 0.21 ppm ZnSO ₄ + 5ml/lit. extract from <i>Capsicum annum</i>	0.0814 \pm 0.0458 (-8.64 %)	0.0810 \pm 0.0374 8.68 %	0.0805 \pm 0.0173 (-8.94 %)

(B)The rate of oxygen consumption of preexposed *Lamellidens consobrinus* to zinc sulphate for 21 days during recovery.

Treatment	Average O ₂ consumed ml/gm/hr/lit. \pm S.D.		
	28 days	35 days	42 days
bivalves preexposed to ZnSO ₄ (0.21 ppm) for 21 days	(D) Normal Water 0.0785 \pm 0.0412 (-11.90 %)	0.0801 \pm 0.0224 (-9.70 %)	0.0803 \pm 0.0245 (-9.16 %)
(E) Normal water + 5 ml/lit extract from <i>c. annum</i>	0.0797 \pm 0.0490 (-10.55 %)	0.0813 \pm 0.0141 (-8.34 %)	0.0824 \pm 0.0300 (-6.79 %)

Figure in bracket indicates percent variation in the rate of O₂ consumption

Discussion

The fresh water bivalve *L. Corrianus* showed mortality against intoxication of heavy metals HgCl₂, ZnCl₂, and Co(NO₃)₃ (Sommanee, 1980; Ong, 1994). Sunil and Nitin (2013) showed that mortality rate increased with exposure time and concentration of HgCl₂, ZnCl₂ increased rate of respiration is noted in bivalve *Lamellidens marginalis* exposed to detergent (Chati *et al.*, 2009). Coasta (1965) studied the effect of toxic substances like PbNO₃, CuSO₄, ZnSO₄ and HgCl₂ on oxygen consumption.. the toxic substances like CuSO₄, ZnSO₄ potassium oxalate, oxalic acid, decreases the rate of oxygen consumption (Wath *et al.*, 1992). Toxicant exposure causes the respiratory disturbance and reduces oxygen consumption in the molluscs (Alam, 1984; Jadhav, 1993; Zambre *et al.*, 1996). The rate of oxygen consumption in fresh water bivalve, *Lamellidens Marginalis* was affected by nickel chloride (Andhale *et al.*, 2012). Toxicants exposure causes respiratory disturbances and reduces O₂ consumption in molluscs.

The prominent mucous secretion on gills was observed during experimentation. These activities are helpful to minimize the toxic effect of toxicants on the body. As bivalve are filter feeder the close contact of gill tissues with polluted water alters the respiratory surface and in turn decreases the diffusion of gases through the gills (Skidmore, 1972; Hughes, 1976). The rate of oxygen consumption was decreased due to role of toxicants as inhibitors acting between i) NADP and coenzymes ii) The chain of cytochrome b and C iii) The inhibitors of cytochrome c oxidase. This inhibitor block energy deviation and affect oxygen uptake. The alternation in the normal respiratory metabolism is due to its intimate contact with polluted water which decrease the oxygen diffusing capacity of gills (Jadhav *et al.*, 2011) the toxicity of heavy metal like Hg, Cd, Zn to *L. consobrinus* affect the respiratory and nervous system of animal resulting into death. The decrease in oxygen consumption might be due to penetration of the pollutant molecules and their action on the alteration of metabolic cycles at subcellular levels (Mahajan and Zambre, 2003). The main pathological effect on respiratory system caused by waterborn essential metals like Zn is primarily internal hypoxia resulting from disruption of gill function (Spicer and Weber, 1991; Koizumi *et al.*, 1994).

In conclusion we determine the toxicity of Zn in the form of LC50 values. After short term acute exposure and upto 7th, 14th and 21st day, the effect of heavy metal Zn on Oxygen consumption in bivalve *L. Consobrinus*. The significant decrease in oxygen consumption observed upto 21st days. This result will clearly indicate that the different contents of capsicum like carotene, flavinoids probably reduces the different respiratory stress and enhances the different pathways involve in the respiratory cycles.

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Conclusion

In conclusion the current study suggests that aqueous extracts of *Capsicum annum* can prevent or slow down the oxidative damage induced by zinc sulphate in *Lamellidens consobrinus*. The effect of zinc on oxygen consumption is variables were decrease by treatment with chilli extracts. This indicates to that, The *Capsicum annum* extract posses antioxidant activity.

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